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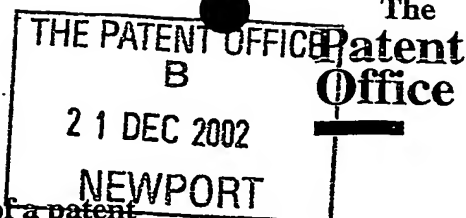
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POWER MANAGEMENT IN SET TOP BOXES

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**DESCRIPTION****POWER MANAGEMENT IN SET TOP BOXES**

The present invention relates to improved power management in set top boxes (STBs) commonly used to receive a range of audio and video broadcasts for display through a users' television set.

STBs receive broadcasting signals from, for example, cable, digital or satellite service providers. The signals are typically fed to a single channel of the associated television set. Other channels are typically reserved for terrestrial television signals, VHS/DVD players or games consoles. Once tuned to the STB signal-receiving channel, a variety of different broadcast signals can be selected for viewing through that channel.

It will be appreciated that a significant amount of power is consumed by an STB when receiving a large number of broadcast signals from a service provider, power that is wasted when none of the broadcasts are being viewed or heard by a user.

In order to conserve energy, modern electronic appliances are commonly provided with a "stand-by" mode. When in this mode, the appliance is essentially switched off, except for a receiving circuit, which is configured to receive a reset signal, for example an infrared signal emitted by a remote control hand set. This mode enables energy that might otherwise be used to power the appliance, to be conserved without the need for disconnecting the appliance from its main power supply.

It is known from US 6,292,943 B1 to provide a power control method for a STB. That method is specifically directed to signalling a STB which is in a "stand-by" mode to switch on and to transmit a broadcast programme which has been selected for recording on a video cassette recorder (VCR). In the method, a VCR is programmed to record a specified program at a specified time. When the VCR prepares to record at the specified time, a signal is sent

to the STB to ensure that the STB is switched on and ready to relay the signal associated with the selected programme for recording by the VCR.

It is known from GB 2 335 806 to provide a switching circuit for switching the power modes of a VCR, DVD and decoder from an "on" mode to "stand by" mode. When one or more of the three appliances is selectively switched to the "on" mode, the switching circuit powers down any appliance not in use.

An object of the present invention is to provide a means by which the energy consumption of a STB is controlled and in particular, reduced when no signal received by the STB is being viewed or heard.

According to a first aspect, the present invention provides a power control method for a set top box, the set top box having an ON power mode and a STAND BY power mode and being in communication with a television set, the method comprising;

monitoring a parameter of an operating signal associated with the television set,

comparing the value of the parameter with predetermined values at which the set top box is desired to be either operative (ON power mode) or inoperative (STAND BY power mode)

when a predetermined value of the parameter is detected, evaluating the current power mode of the set top box and if this is not the desired power mode, initiate a change in operation of the set top box from its current power mode to the desired power mode.

In one simple embodiment, the operating signal is the electricity supply passing through the power cord to the television set. Optionally, the parameter monitored is the electric current passing through the power cord. It will be understood that when the television set is switched on so as to display a broadcast programme, the electric current will be significantly higher than when the set is switched off or in stand by mode. In such an arrangement, when a predetermined electric current value, higher than that associated with

the television set being off or in stand by mode is detected, operation of the set top box in ON power mode is initiated. When the electric current value falls below this predetermined value, the operation of the set top box is switched to stand by mode. Thus, the set top box can be configured to switch to its ON mode, automatically, when the television set is on, or to its STAND BY mode when the television set is switched off or to stand by. It is to be understood that whilst the specific example of current is given here, with suitable sensors, other variable parameters of the electricity supply could be monitored without materially affecting the mode of operation of this embodiment.

This first embodiment of the method may be effected by a suitably adapted electrical socket into which the power cable of the television set is plugged and which is in electrical communication with a controller for the set top box. Sensors in the socket monitor a chosen parameter (eg current, voltage or resistance) passing to the power cable and the television set, when the sensors detect that a pre-determined value, for example, of the electric current has been reached or exceeded, this information is relayed to the controller which in turns signals the set top box to power up to full ON power mode. Conversely, when the sensors detect that the current monitored has fallen below the predetermined value, the controller signals the set top box to power down to STAND BY mode.

In an alternative, embodiment, the operating signal monitored is the frequency of the oscillator/mixer of the television set. One particular frequency will define the channel through which the services received by the set top box are received. When this pre-determined frequency is detected, the set top box is operated in full ON power mode, when the frequency is other than the pre-determined frequency, the set top box is operated in STAND BY mode.

Such an embodiment of the method can be effected with the use of an RF cable connecting the controller of the set top box with the television set. Leakages down the RF cable can be monitored for occurrences of the pre-determined frequency. Detection of the pre-determined frequency signals a controller of the set top box to operate the box in ON power mode. Detection

of a different frequency, or zero frequency, signals the controller to operate the box in STAND BY mode.

In another alternative embodiment, the operating signal is the line scan of images displayed on the screen of the associated television set (having a cathode ray tube display). Thus, the predetermined "value" may be the presence or absence of a line scan. Magnetic field detection can be used as a means of detecting the line scan rate.

In a more complex version of this embodiment, line scans may incorporate signatures which can be recognised by a controller of the set top box as relating to a broadcast made by the service provider whose broadcasts the set top box is configured to receive. The "parameter" monitored would be a signature of the line scan. Thus, in this more complex version, the set top box is configured to operate in ON mode only when the television set is on and the viewer is viewing a programme received through the set top box.

The signature of the line scan may be a subtle alteration of the timing and/or frequency of the line scan associated with a particular service provider. An alternative arrangement is possible, with the signature of the line scan being an STB generated signal. In this embodiment, even if there are multiple pieces of equipment connected to the TV (such as STBs, games consoles etc.) each one can uniquely identify its own signal. This would not be too difficult to achieve in a digital system where the video is played out of a frame buffer – there will be a system clock controlling this that can be altered.

Whatever parameter is actually monitored, the STB can operate a system whereby it establishes a threshold level of the switching parameter. This could be done adaptively by observation. So for example, the STB could monitor power current for the TV over a period and find a high range and a low range of power usage (corresponding to on and standby). Having done this it could set the threshold in the gap between these ranges, for example at the half way point. In this way adaptive determination of the threshold is achieved.

Whilst this specification is primarily directed to STBs, it is to be understood that certain embodiments may equally be applied to the power

management of other TV peripherals such as DVD players, VCRs and games consoles.

For the purposes of exemplification, there now follows a brief description of some embodiments of the invention as shown in the accompanying Figures of which:

Figure 1 shows in flow chart form, the power management method performed by a controller of a set top box in accordance with the invention;

Figure 2 shows a first embodiment of a device for use in performing the power management method of the invention; and

Figure 3 shows a second embodiment of a device for use in performing the power management method of the invention;

As can be seen from figure 1, in step S1, a sensor forming part of a controller system for the STB, monitors a characteristic parameter of an operating signal associated with the television set, for example, the current associated with the power supply to the TV set. The controller is programmed to recognise one or more predetermined values of the measured parameter, for example a maximum and/or or minimum predetermined value (PDV) of the parameter which is associated with a recognisable state of the TV set. Where the parameter is the electrical current, the sensor/controller are programmed to recognise a minimum value above which the TV set is assumed to be in use, and the STB needed in its ON mode and/or a minimum value below which the TV set is assumed to be off or in stand by mode and the STB is required to be in its STAND BY mode. The maximum and/or minimum value (i.e the predetermined value (PDV)) may be a single value of current. In step S2, if the sensor detects a change in the parameter with respect to the PDV (for example, the value of the parameter changes from a value above the PDV to a value below the PDV), the controller proceeds to step S3 and checks whether the current power mode of the STB matches the desired power mode



for the given value of the parameter. If there is not a match, then the controller changes the power mode to the desired power mode.

As previously discussed, in other embodiments, the PDV may be, for example a frequency range consistent with frequencies through which the STB signal is received by the TV set, or a line scan signature unique to the provider of the broadcast service received by the STB. The power mode is checked whenever the value of the monitored parameter falls outside or into the range.

Figure 2 illustrates a first embodiment of the invention. As can be seen, a STB 1 is associated with a TV set 2. A socket 3 includes a sensor (not shown) for detecting changes in electrical current passing through the socket. The socket is electronically connected with the STB 1 and communicates with the controller 6 of the STB. The power plug 4 for the TV set 2 is received by the socket 3. The socket 3 in turn is equipped with a power plug 5 which can be inserted into the mains power supply whereby to provide power for the STB 1, the socket 3 and the TV set 2. When the TV set 2 is in its ON mode, it will drain more current from the power supply via the socket 4 than when it is switched off or in reduced power STAND BY mode. As previously discussed, the socket 3 communicates changes in current to the controller 6 of the STB 1, which in turn effects appropriate changes in the power mode of the STB.

Figure 3 shows a second embodiment of the invention wherein a STB 31 includes a controller 33 which is in communication with an RF cable 36 which in turn connects with a TV set 32. The TV set 32 also has an aerial 34 (which may connect through the STB 31) and a mains plug 35 through which, respectively, broadcasts are received and power is supplied to the TV set. The STB may also have its own power supply (not shown). The RF cable detects leakage from the oscillator/mixer of the TV set (not shown) from which the frequency of signals viewed on the TV set can be determined. In this case, the controller 33 is programmed to recognise as a PDV a frequency or frequency range associated with broadcasts viewed through the STB. When such frequencies are detected, the controller switches the STB to its ON

mode, when the detected frequency falls outside the range; the controller switches the STB to STAND BY mode.

## CLAIMS

1. A power control method for a set top box, the set top box having an ON power mode and a STAND BY power mode and being in communication with a television set, the method comprising;  
monitoring a parameter of an operating signal associated with the television set,  
comparing the value of the parameter with predetermined values at which the set top box is desired to be either operative (ON power mode) or inoperative (STAND BY power mode)  
when a predetermined value of the parameter is detected, evaluating the current power mode of the set top box and if this is not the desired power mode, initiating a change in operation of the set top box from its current power mode to the desired power mode.
2. A power control method as claimed in claim 1 wherein the operating signal is the electricity supply to the TV set.
3. A power control method as claimed in claim 2 wherein the parameter is the current of the electricity supply.
4. A power control method as claimed in claim 3 wherein a predetermined value corresponds to a minimum above which the TV set is known to be switched on.
5. A power control method as claimed in claim 1 wherein the operating signal is the TV signal displayed on the TV set and the parameter is the frequency at which the signal is received.
6. A power control method as claimed in claim 5 wherein a predetermined value is the frequency or frequency band at which the STB receives

services from the service provider whose broadcasts the STB is configured to receive.

7. A method as claimed in claim 1 wherein the operating signal is the line scan of images displayed by the TV set and the predetermined value is the presence or absence of a scan line.
8. A method as claimed in claim 7 wherein the line scan incorporates a signature unique to a broadcast service provider whose services are received through the STB.
9. A method as claimed in claim 7 wherein the predetermined value is presence or absence of the signature.
10. An apparatus for controlling the power mode of a set top box (STB) when in communication with a TV set, the apparatus comprising;  
an electrical socket configured to receive the power plug of a TV set, the socket being electrically connectable to a mains electricity supply and including means for sensing changes in one or more characteristic parameters of the electricity supply passing through the socket and means for communicating the sensed changes to a controller of the STB.
11. An apparatus for controlling the power mode of a set top box (STB) when in communication with a TV set, the apparatus comprising;  
a STB having a controller and an RF cable able to communicate with the oscillator/mixer of a TV set and with the controller of the STB, whereby to monitor the frequency or frequency band to which the oscillator/mixer is tuned, the controller being configured to perform the method of any one of claims 1, 5 or 6.

12. An apparatus for controlling the power mode of a set top box (STB) when in communication with a TV set, the apparatus comprising;  
a STB and a line scanner configured for monitoring the line scan of a cathode ray tube type TV set and able to communicate with a controller of the STB, whereby to monitor the line scan of images displayed on a screen of the TV set, the controller being configured to perform the method of any one of claims 1, 7, 8 or 9.
13. A computer program which when operated on a computer causes the computer to perform the method of any of claims 1 to 9.
14. A set top box for a television incorporating a controller which includes a computer programmed with the computer program of claim 13.

**ABSTRACT****POWER MANAGEMENT IN SET TOP BOXES**

The invention comprises a power control method for a set top box, the set top box having an ON power mode and a STAND BY power mode and being in communication with a television set, the method comprising; monitoring a parameter of an operating signal associated with the television set, comparing the value of the parameter with predetermined values at which the set top box is desired to be either operative (ON power mode) or inoperative (STAND BY power mode) when a predetermined value of the parameter is detected, evaluating the current power mode of the set top box and if this is not the desired power mode, initiating a change in operation of the set top box from its current power mode to the desired power mode.

[Figure 1]

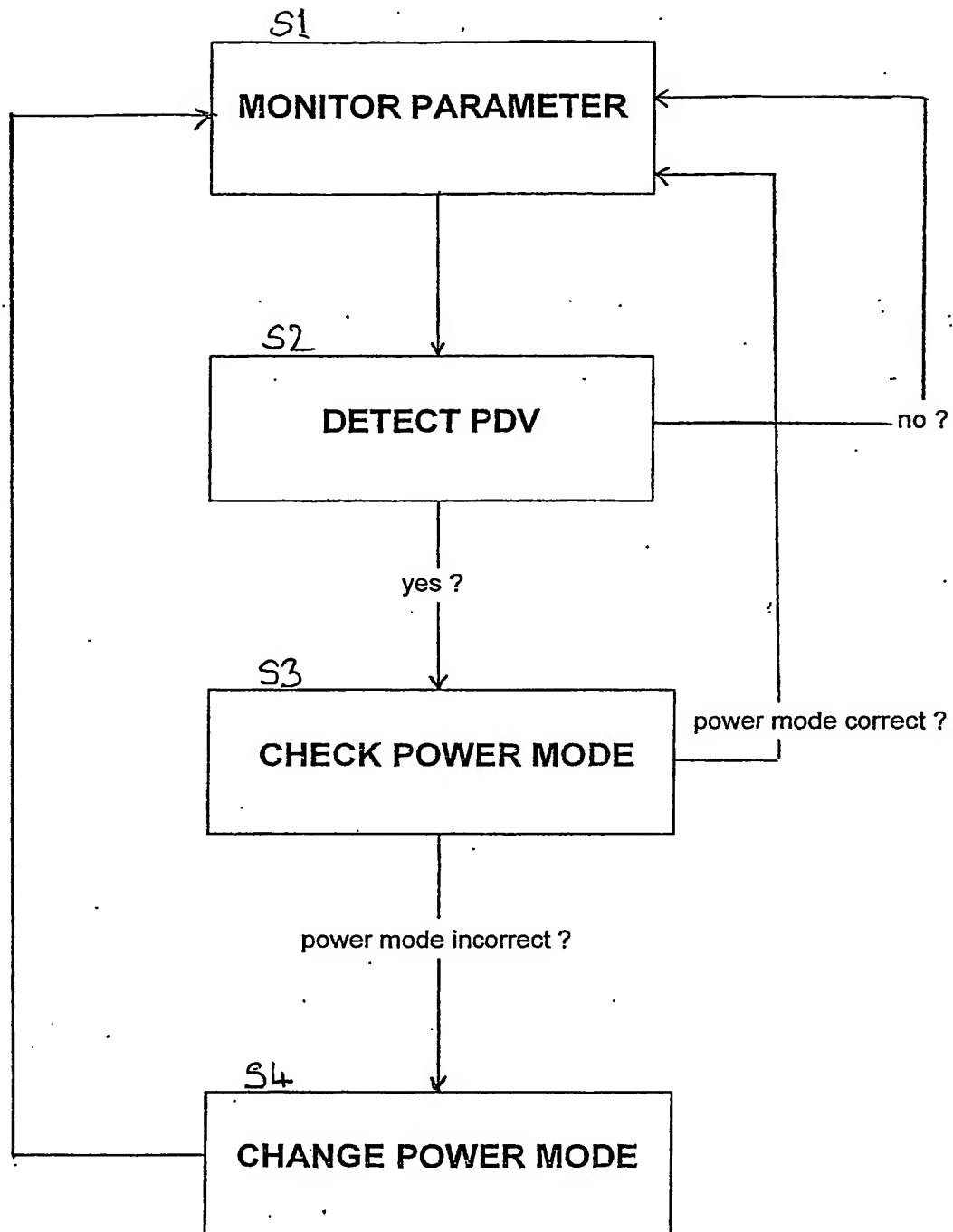


FIG.1

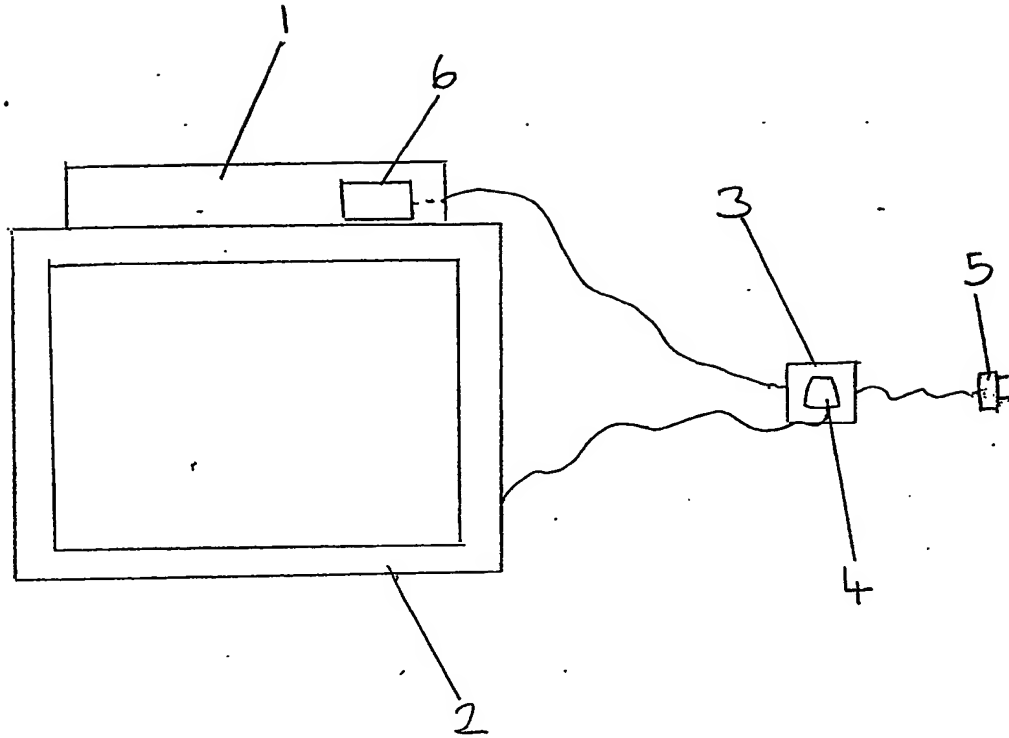


FIG 2



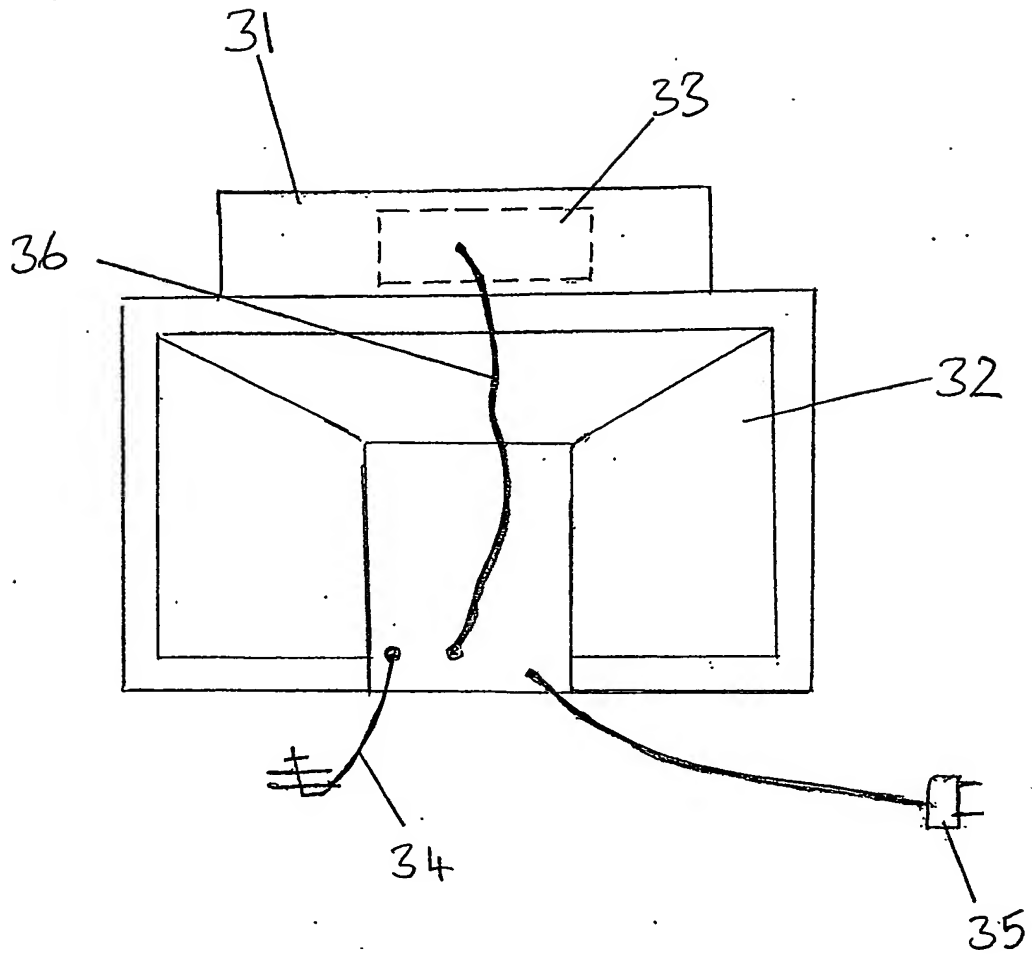


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